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ENGINEERING SOILS MAP OF FAYETTE COUNTY, INDIANA

JUNE 1967

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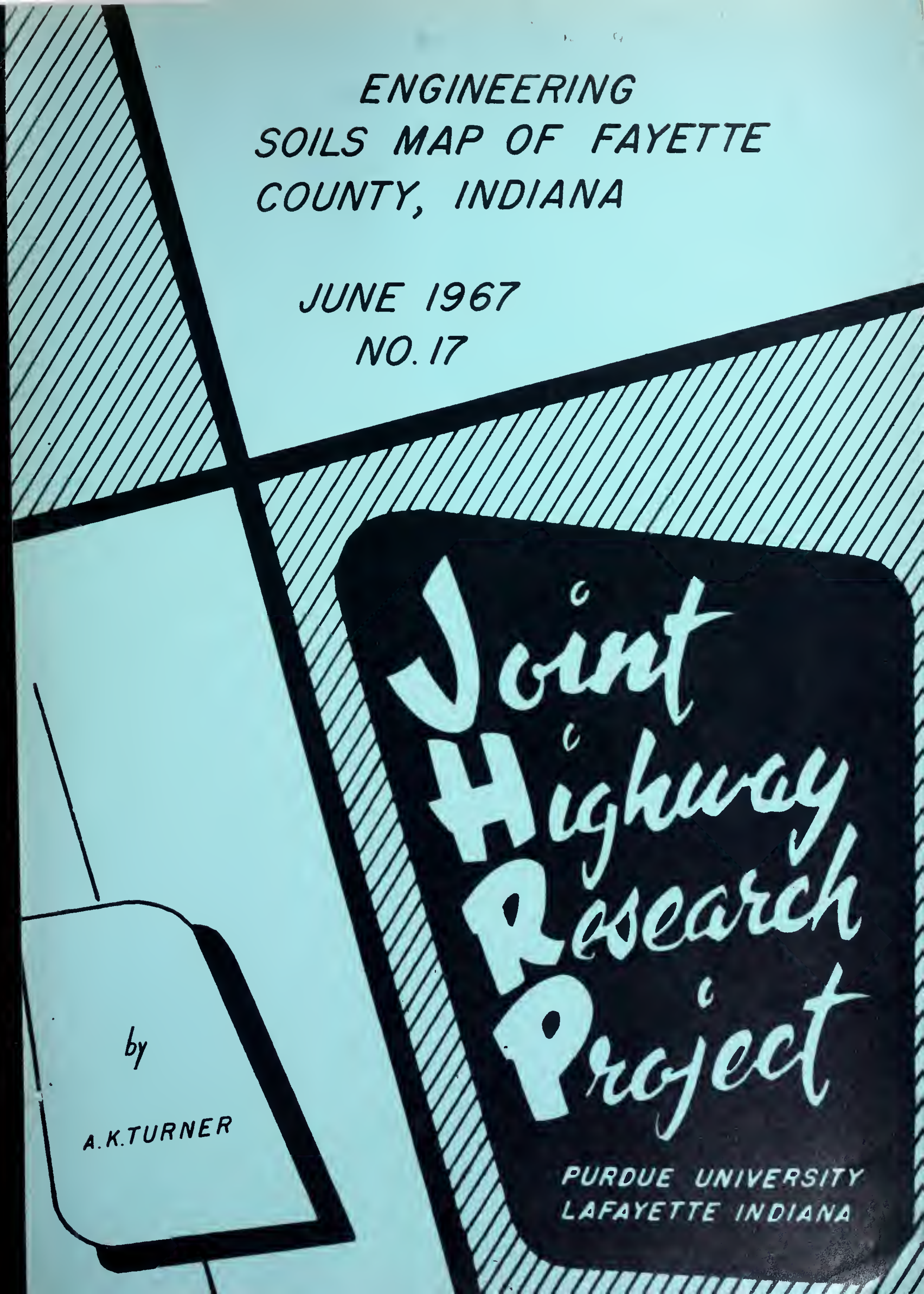

by

A.K. TURNER

Joint Highway Research Project

PURDUE UNIVERSITY
LAFAYETTE INDIANA

Interim Report

ENGINEERING SOILS MAP
OF FAYETTE COUNTY INDIANA

TO: Dr. G. A. Leonards, Director
Joint Highway Research Project

June 20, 1967

File: 1-5-2-43

FROM: H. L. Michael, Associate Director
Joint Highway Research Project

Project: C-36-51B

The attached report, entitled "Engineering Soils Map of Fayette County, Indiana," completes a portion of the project concerned with development of county engineering soils maps of the State of Indiana. This is the 43rd report in the series. The report was prepared by A. K. Turner, Research Instructor, Joint Highway Research Project.

The soils mapping of Fayette County was performed primarily by using the soil survey map sheets published by the Soil Conservation Service, United States Department of Agriculture in the soil survey of Fayette and Union Counties. Airphoto interpretation techniques were used to supplement the pedological data. The resulting Engineering Soils Map is presented as a blackline print.

Respectfully submitted,

Harold L. Michael/jgs
Harold L. Michael
Associate Director

HLM:ss

Attachments: One

Copy:
F. L. Ashbaucher
W. L. Dolch
W. H. Goetz
W. L. Grecco
G. K. Hallock
R. H. Harrell
V. E. Harvey
J. F. McLaughlin
F. B. Mendenhall
R. D. Miles
J. C. Oppenlander
C. F. Scholer
M. B. Scott
W. T. Spencer
F. W. Stubbs
H. R. J. Walsh
K. B. Woods
E. J. Yoder

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Interim Report

ENGINEERING SOILS MAP OF FAYETTE COUNTY, INDIANA

by
A. K. Turner
Research Instructor

Joint Highway Research Project

Project: C-36-51B

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Prepared as Part of an Investigation

Conducted by

Joint Highway Research Project
Engineering Experiment Station
Purdue University

in cooperation with

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U. S. Department of Commerce

The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the Bureau of Public Roads.

Not Released for Publication

Subject to Change

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Indiana State Highway Commission
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Purdue University

Lafayette, Indiana

June 20, 1967

ENGINEERING SOILS MAP
OF
FAYETTE COUNTY, INDIANA

by

A. K. Turner

INTRODUCTION

Development of an engineering soils map of Fayette County was the primary goal of this project. The map is appended to this report; the report supplements the engineering soils map information.

The detailed pedological soils maps published in the 1960 Soil Survey of Fayette and Union Counties by the United States Department of Agriculture (7) were the single most important source of data used in the project. These agricultural soils map sheets, at a scale of 1:15,840, were assembled to form a mosaic map of Fayette County. Careful study of the soil series descriptions enabled the grouping of the series into appropriate landform and parent material categories. Preliminary landform and parent material boundaries were then delineated on the mosaic-map.

Routine airphoto interpretation techniques supplemented the pedological data. Aerial photographs were examined and the preliminary boundaries checked and modified, if necessary, to produce final landform and parent-material boundaries. The photographs were contact prints at an approximate scale of 1:20,000. Date of photography was 1940.

Published geologic reports were studied to verify and amplify the soils information. Most important of these were the reports of Dr. Ansel M. Gooding, Department of Geology, Earlham College, Richmond, Indiana (2,3,4). He has made detailed studies of the glacial deposits in this area. His report on the terraces along the Whitewater River (2) contains much

detailed information beyond the scope of this report.

The final landform and parent-material boundaries were graphically reduced to produce the engineering soils map. Symbols were used to delineate the parent materials (grouped according to landform and origin). Textural symbols were then superimposed to indicate the relative compositions of the parent materials. The map also includes a set of soil profiles which indicate the general soil profiles of topographically high and low sites in each parent material area. Each profile shows the general range in depth and texture (ISHC textures) of each soil horizon. Because of the obviously bad construction characteristics of highly organic top-soils, these materials were carefully mapped. However not all of the identifiable areas of these materials were large enough to be shown on the relatively small scale engineering soils map.

DESCRIPTION OF THE AREA

General Nature of the County

Fayette County is located in east-central Indiana, separated from the Indiana-Ohio State-line by Union County (Figure 1). It has a maximum north-south length of 18 miles, and a width of 14 miles. Total area is 215 square miles (6). Connersville, the county seat, is located in the east-central part of the county about 55 miles east-southeast of Indianapolis, and reports a 1960 population of 17,698 out of a total county population of 24,454 (8). Several small to medium sized industries are located in Connersville, however about 90 percent of Fayette County is farmed (7). Agriculture is mainly concerned with the raising of livestock, chiefly hogs. Thus considerable cleared land, and much woodland, is devoted to pasturing; while forage crops, especially corn, hay, and wheat, are the main crops (7).

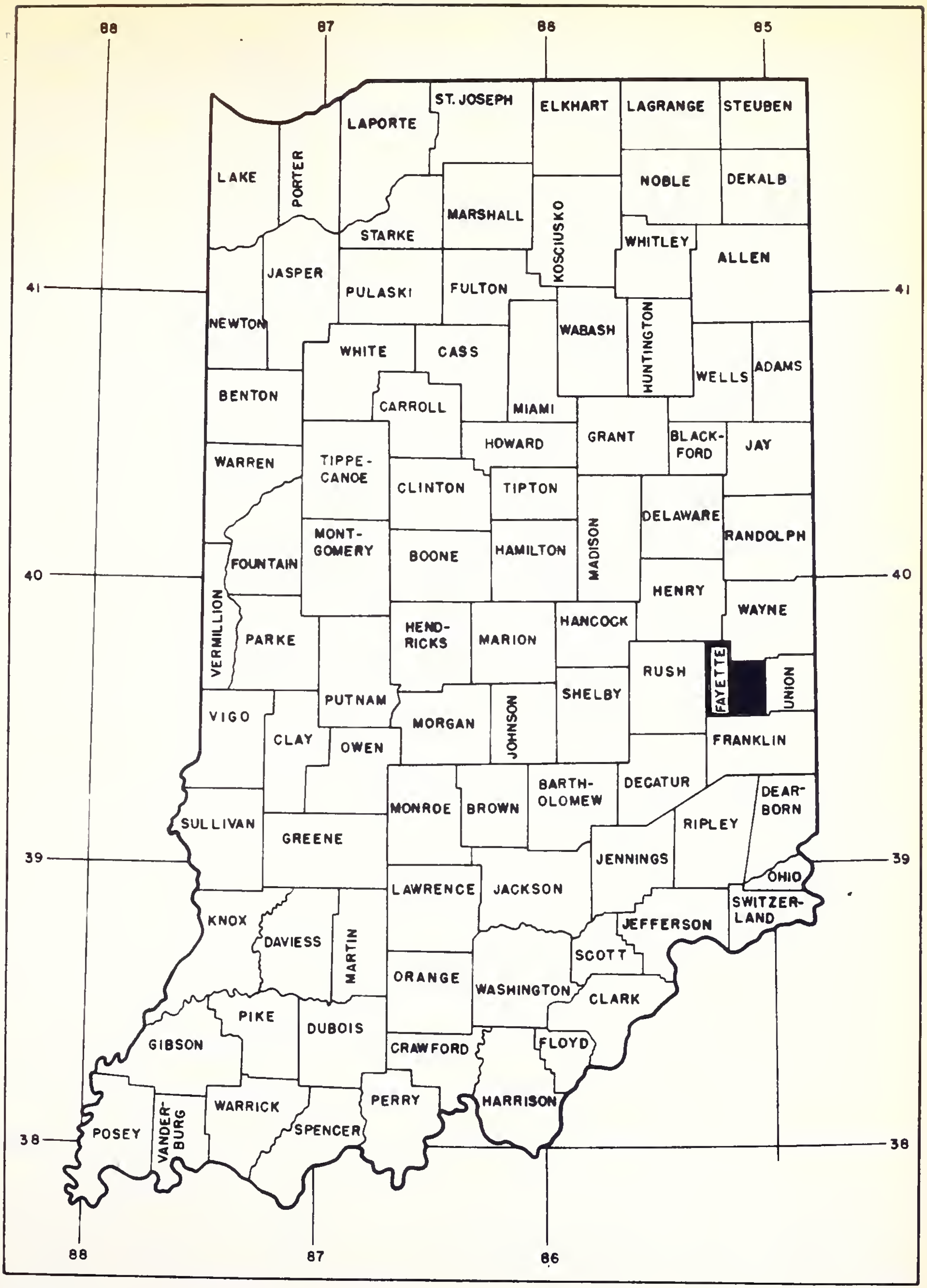

FIGURE I

LOCATION MAP OF FAYETTE COUNTY

Climate

Table 1, derived from the Agricultural Soil Report summarizes temperature and precipitation data obtained at Rushville, Indiana, and believed typical of Fayette County conditions (7).

Fayette County has a continental type of climate with erratic temperature changes within and between seasons. The winters are moderately cold; the summers warm and humid. Analysis of the mean monthly temperatures shows the county to have a freezing index of 192 degree days. Yoder (11) shows that this might indicate a frost penetration of 20 inches in a well-drained non-frost-susceptible base course. The winter season is particularly marked by rapid temperature changes. Commonly periods of two or three days of subzero weather are followed by short periods of warm weather. As a consequence damage from freezing and thawing of highway subgrades can be expected.

Rainfall varies from season to season. Heaviest rains occur in the spring; flooding of the Whitewater River is common.

Physiography, Topography, and Drainage

Fayette County lies within the Till Plains Section of the Central Lowland Province (1, 10). However, since the glacial drift is very thin over most of the southern and central parts of the county, Malott (5) has included essentially all of the county within the northern portion of the Dearborn Upland physiographic region of the State.

Elevations in the county range from a low of about 730 feet, where the West Fork Whitewater River leaves the county, to a high slightly in excess of 1100 feet, found in the western and northwestern parts of the county. Figure 2B gives a general picture of the topography of the county. The surface is that of a glacial plain conforming somewhat to the irregularities of the underlying bedrock surface. The uplands have been much dissected

TABLE 1

Temperature and Precipitation Data for Fayette County*

Month	Temperature (°F)			Precipitation (inches)		
	Mean	Extreme High	Extreme Low	Mean	Extreme Dry	Extreme Wet
Jan.	28.7	70	-26	3.39	0.71	12.06
Feb.	29.9	71	-25	2.83	0.32	8.31
Mar.	39.9	86	-10	3.96	0.04	12.08
April	50.4	89	14	3.69	0.90	9.11
May	61.6	96	26	4.10	0.53	8.46
June	70.2	101	35	3.93	0.71	8.45
July	74.2	108	40	3.33	0.20	7.96
Aug.	71.6	103	36	3.15	0.29	9.64
Sept.	61.3	101	22	3.38	0.17	9.36
Oct.	54.4	90	12	2.83	0.23	9.11
Nov.	41.3	83	-10	3.17	0.37	9.25
Dec.	31.0	68	-21	2.97	0.48	6.14
Annual	51.5	108	-26	40.73	0.04	12.08
Number of years of records	67	75	75	77	77	77

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* This data obtained from Agricultural Soil Survey of Fayette and Union County by USDA. The recording station was at Rushville Indiana, in adjacent Rush County, since 1948; prior to 1948 the station was at Mauzy Indiana. Rushville station location is Lat. 39° 36'N.; Long. 85° 27'W. ground elev. = 955 feet.

adjacent to the valleys of the West Fork Whitewater River and its tributaries where local relief is about 250 feet. The valley is fairly wide with extensive multiple terraces in the northern part of the county; it narrows in the southern part.

With the exception of the west-central and northwestern parts of Fayette County, which lie within the East Fork White River drainage basin, the county lies within the Whitewater River drainage basin. The West Fork Whitewater River is the trunk stream for most of the county. Major tributaries are Williams, Fall, Garrison, Village, Wilson, and Bear Creeks. Small areas along the eastern county boundary drain into the East Fork Whitewater River. Figure 2A shows the drainage system within the county.

Geology

Bedrock Geology

Bedrock underlying the western third of the county is of Silurian age; the remainder is of Ordovician age. Limestone and interbedded limestone and shale are the common rock types. Rock outcrops are restricted to stream beds and valley walls. They become larger and more numerous in the southern part of the county where many creek-beds are littered with small blocks of flaggy limestone. Most streams in the southern part of the county are rock-controlled.

Glacial Geology

Glacial deposits belonging to the older Illinoian and the younger Wisconsin ice sheets are found in Fayette County. Each of these ice sheets advanced and retreated several times. It is believed that the Illinoian ice sheet advanced and retreated over the county at least three times (3). Consequently three Illinoian tills, separated by outwash

FIGURE 2A

TOPOGRAPHIC MAP
FAYETTE COUNTY
INDIANA

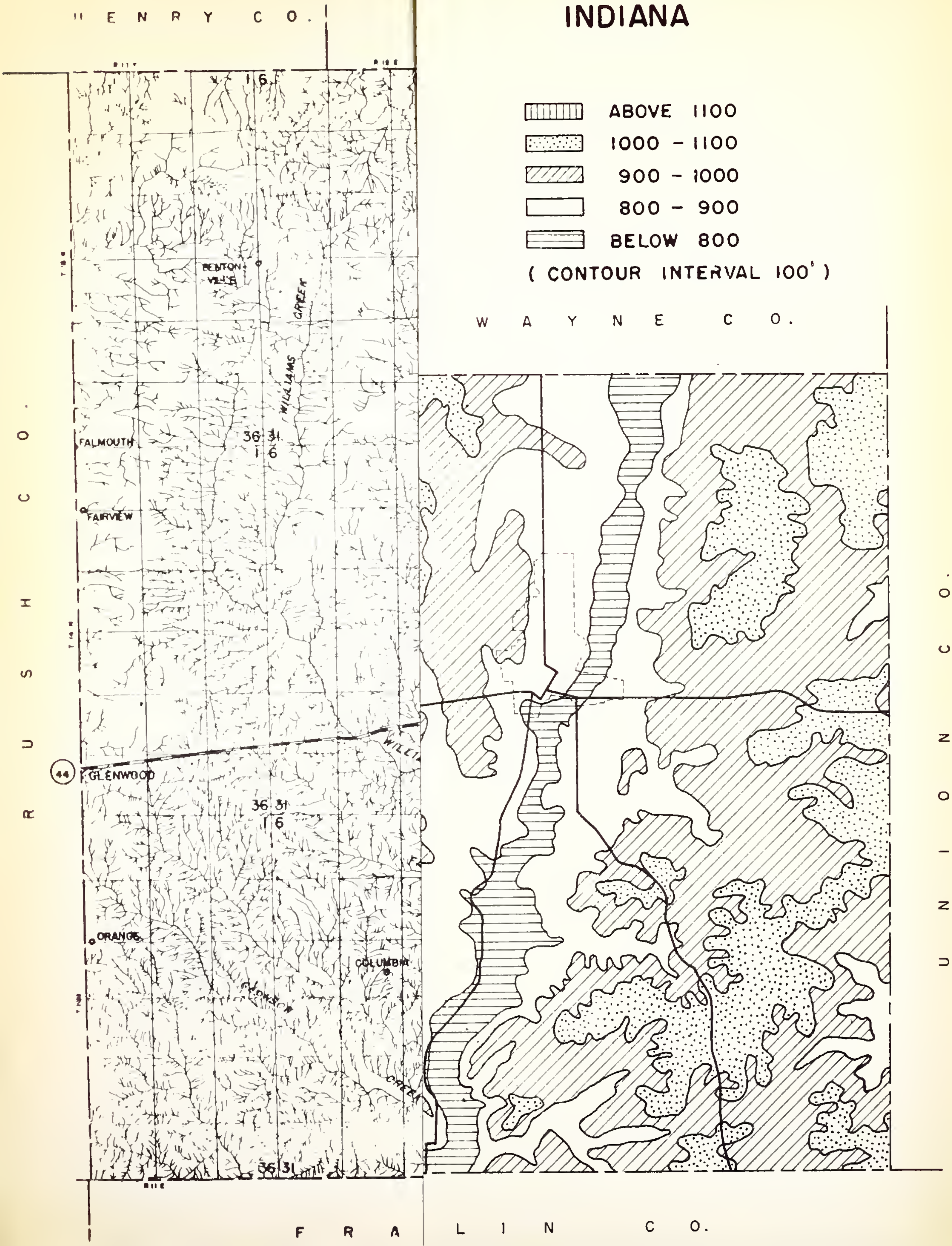
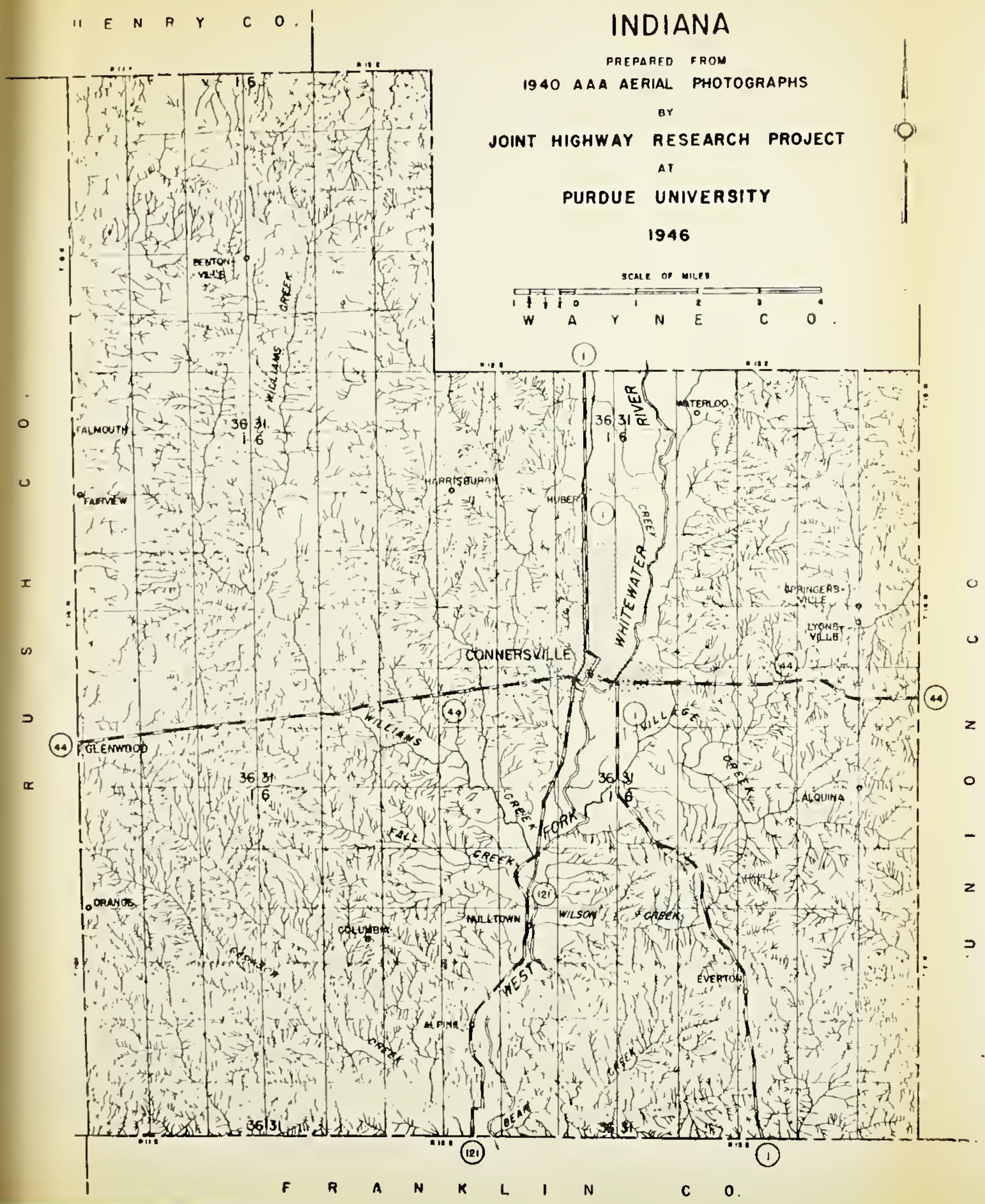
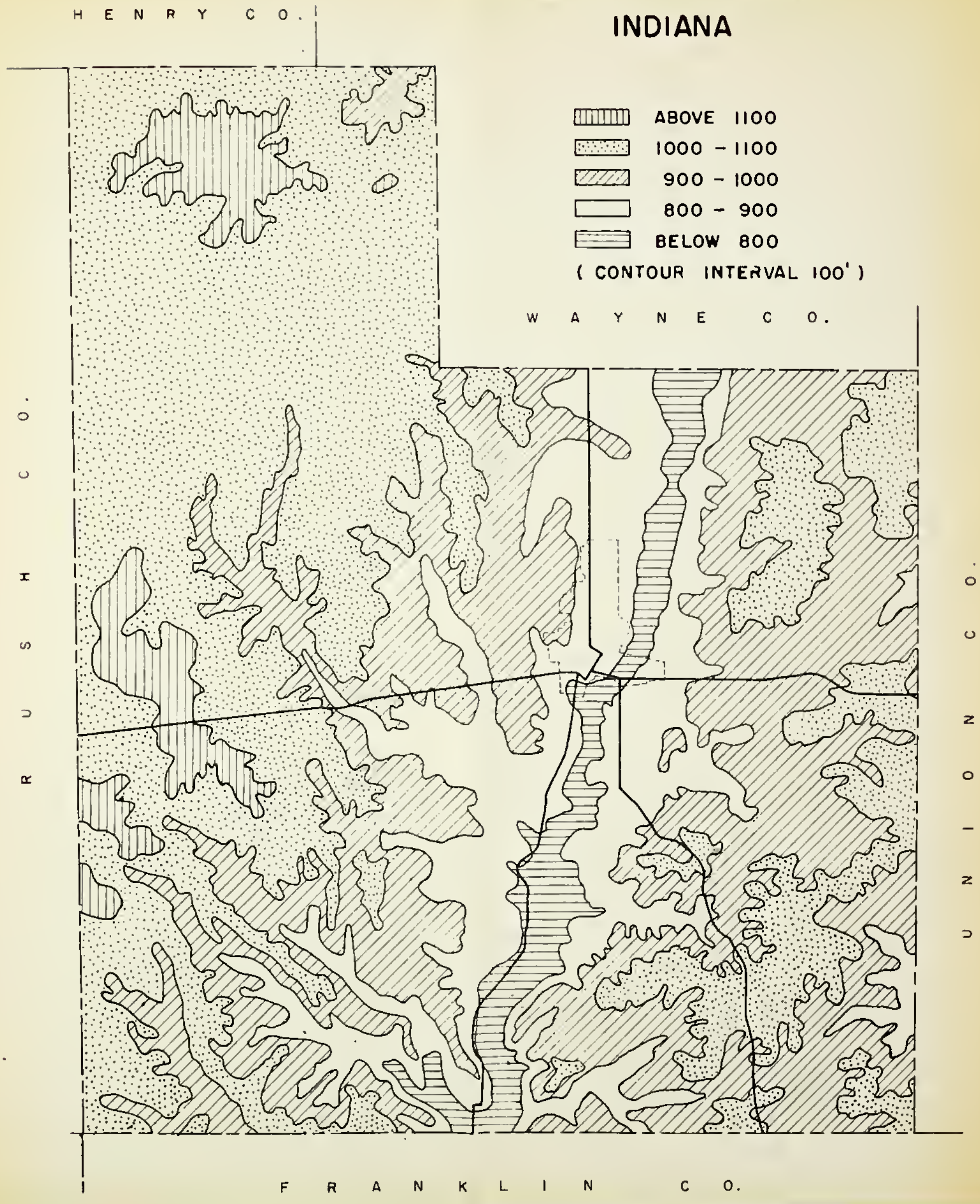


FIGURE 2A



DRAINAGE MAP
FAYETTE COUNTY
INDIANA
PREPARED FROM
1940 AAA AERIAL PHOTOGRAPHS
BY
JOINT HIGHWAY RESEARCH PROJECT
AT
PURDUE UNIVERSITY
1946

FIGURE 2B



TOPOGRAPHIC MAP
FAYETTE COUNTY
INDIANA

▥ ABOVE 1100
░ 1000 - 1100
▨ 900 - 1000
☐ 800 - 900
▤ BELOW 800
(CONTOUR INTERVAL 100')

gravels and sands or eolian silts, have been identified in the area (3, 4).

At least three different Wisconsin advances affected parts of Fayette County. The first advance covered the northeast half of the county, as shown in Figure 3. A distinctive red-brown "Whitewater till" has been found in deep excavations in Fayette and adjacent counties (3, 4). Following retreat of this ice-sheet, a new advance occurred. "Shelbyville" drift deposited from this glacier covers most of the county, with the exception of a south-central area (see Figure 3). A later, much weaker, readvance barely extended into the northwest part of the county. This "Champaign" drift forms a weakly developed ridge moraine and is the youngest glacial deposit in the county.

A complex series of terraces is found along the West Fork Whitewater River and some of its tributaries. Gooding (2) has identified six levels and related these to the various glacial advances. For engineering purposes a two-fold division, into "high" and "low" terraces, appears adequate. The higher terraces are older than the lower terraces, and therefore have different origins. It is thus not surprising that the terrace levels have somewhat different parent materials-the upper terraces are composed of a silt cover overlying sands and gravels; the lower terraces are generally more variable, their compositions ranging from sand and gravel to sand and silt. The lower terraces lack a consistent silt cover common to the upper terraces.

Wisconsin materials exposed at the surface are of either "Shelbyville" or "Champaign" age. The older Shelbyville deposits are more dissected than the younger Champaign areas. A "loess blanket," one to five feet thick, covers the Shelbyville tills, but is thinner or absent on the Champaign till.

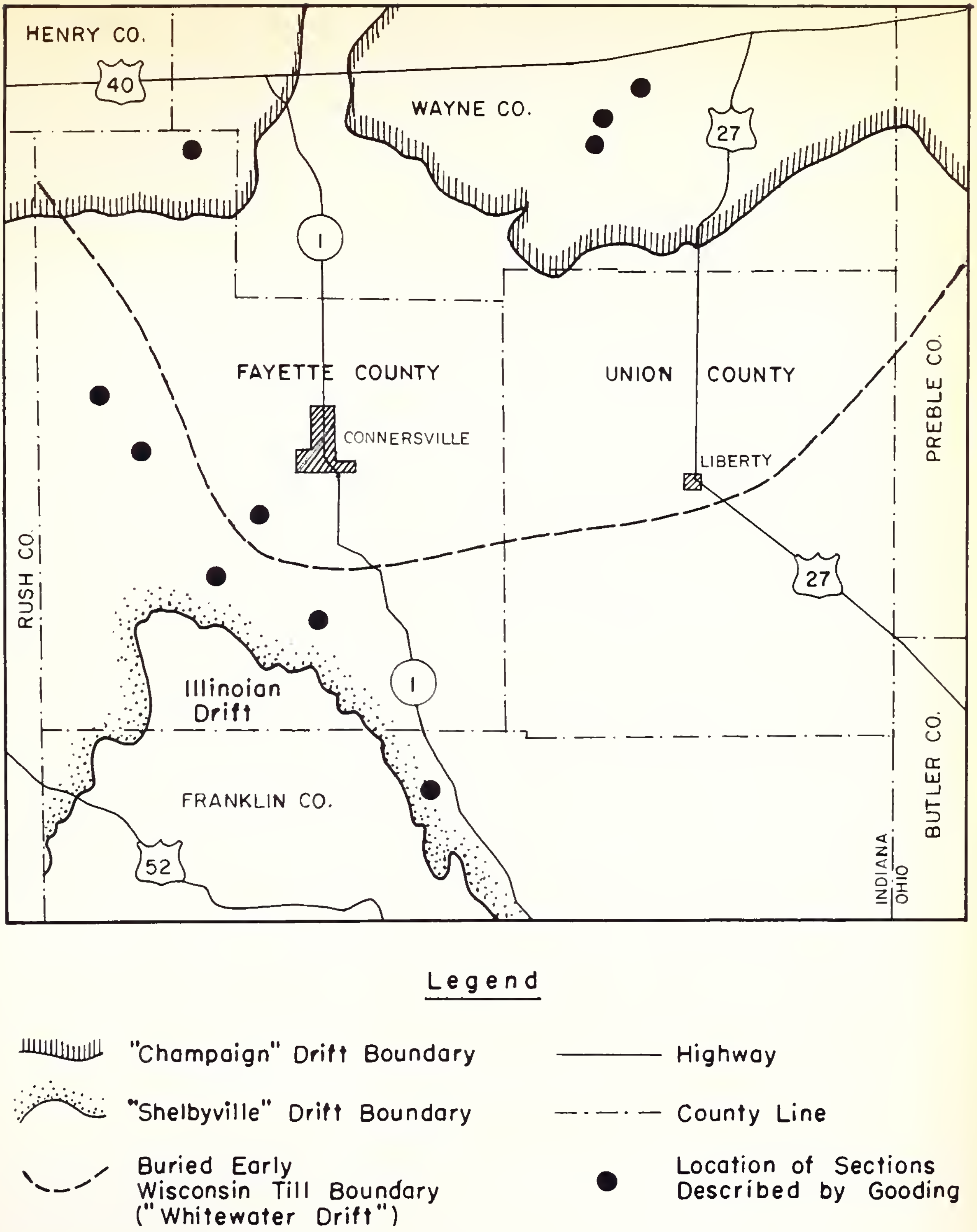


FIGURE 3

MAP SHOWING LOCATION OF WISCONSIN DRIFT BOUNDARIES IN FAYETTE AND UNION COUNTIES

(after A.M. Gooding 1961, 1963)

The accompanying engineering soils map differentiates areas where this loess cover is approximately three or more feet thick. The younger Champaign drift forms a weak ridge moraine extending across the northwest corner of the county. Gently rolling topography, generally higher elevations, and an occasional closed depression serves to separate this area from the flatter (except where later erosion has occurred) Shelbyville till plain.

Older geological reports (5) suggest the presence of two north-south trending ridge moraines, one on each side of the West Fork Whitewater River valley. Airphoto interpretation and topographic map study tends to discount the presence of these "ridge moraines." The areas on each side of the valley are much dissected by stream erosion. However no true closed basins exist and the maximum elevations are lower than the uplands further from the valley. The present study indicates that, for engineering purposes at least, these areas are best classified as till plains.

Several eskers and kames occur on the east side of the West Fork valley south-east of Connersville. Two valleys, which at one time acted as spillways carrying glacial meltwaters from Union County to the east, enter the West Fork valley at this point. One spillway trends northeast toward Lyonsville; the other trends east toward Alquina. The eskers and kames are apparently closely related to these spillways since they are rare in other parts of the county.

LANDFORMS AND ENGINEERING SOIL AREAS

Landforms

Fayette County contains a variety of landforms. Five major categories are easily recognized. They are as follows:- 1) Ridge Moraine of Late Wisconsin age, 2) slightly dissected Till Plains of Early Wisconsin age, 3) dissected Illinoian Till Plains overlying bedrock at shallow depths,

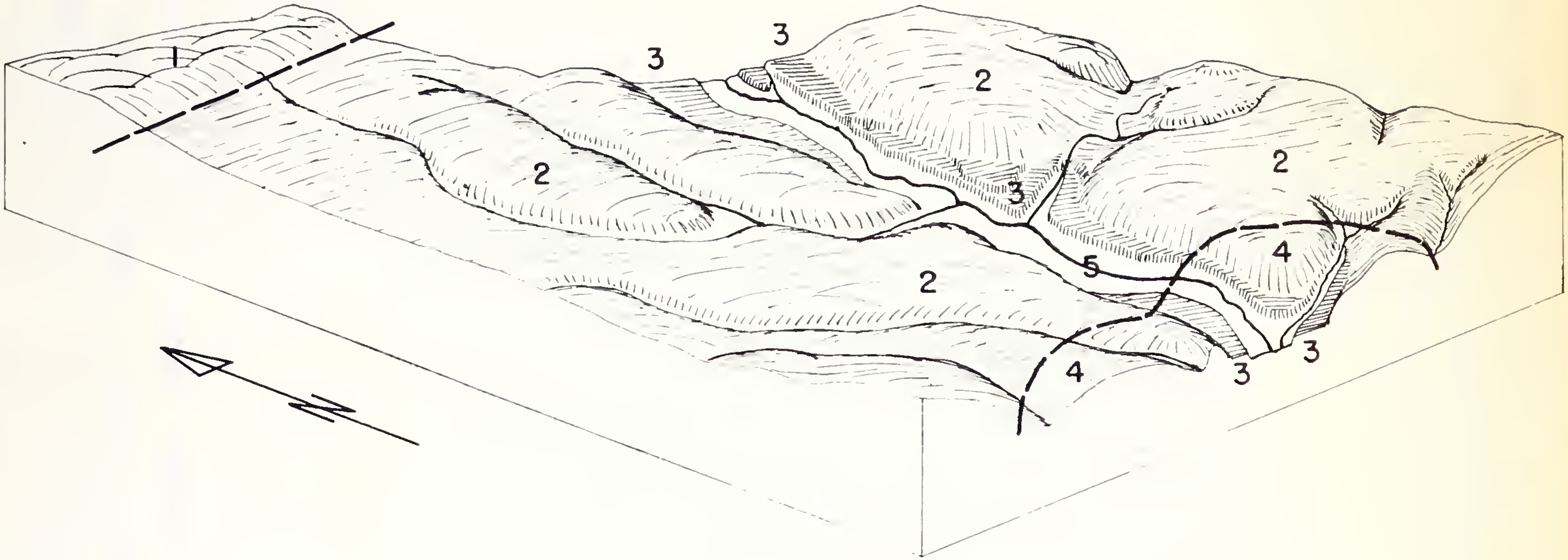


FIGURE 4
LANDFORMS OF FAYETTE COUNTY

(after Fig.8, Soil Survey of
Fayette and Union Counties)

Legend

1 - Wisconsin Ridge Moraine
2 - Wisconsin Ground Moraine (dissected)
3 - Terraces
4 - Illinoian Ground Moraine
5 - Floodplain

4) River Terraces, and 5) river Flood Plains. Figure 4 shows in an idealized fashion the general relationships of these landforms. There are also several minor landforms, including eskers, kames, small outwash plains, and small loess deposits.

The six different terrace levels described by Gooding (2) have here been grouped into two types:- high terraces which are generally 20-35 feet above the flood plain and consequently are well drained and low terraces which are generally only 5-15 feet above the flood plain and are usually poorly drained. Also, the composition of the terraces materials is generally different; the high terraces normally consist of gravel and sand, overlain by silty sands, while the low terraces are more variable, varying in composition from sand and gravel to sand and silt.

Engineering Soil Areas

The soils of Fayette County can be divided into four major groups which reflect their origins:- (a) Glacial deposits, (b) Fluvial deposits, (c) Eolian deposits, and (d) Miscellaneous deposits. These can be further subdivided by landform and parent materials into a number of distinctive units as shown on the enigneering soils map and as listed in Table 2. Table 2 also shows the relationships between these landform-parent material subdivisions and the soil series names employed by the pedologists in mapping the soils of Fayette County (7).

A) GLACIAL DEPOSITS

Upland areas throughout the county are mantled with a variety of glacial deposits. In the south-central part of the county a thin layer of Illinoian ground moraine overlies limestone and shale bedrock. Most of the remaining upland areas are covered with Wisconsin ground moraine overlain by a thin wind-blown silt layer. A low ridge moraine formed by

TABLE 2

Summary of Landforms and Materials in Fayette County

ORIGIN	LANDFORM	PARENT MATERIAL	SOIL SERIES
GLACIAL DEPOSITS	Ridge Moraine (Young Wisconsin)	Silty-clay till with sand lenses	Miami, Crosby
	Wisconsin Ground Moraine (Older Wisconsin)	Clayey-silt overlying silty-clay till	Fincastle, Xenia Russell, Miami, Hennepin, Celina
	Illinoian Ground Moraine	Clayey-silt till (rock often at shallow depths)	Avonburg, Cincinnati, Hennepin
	Eskers and Kames	Outwash, sands and gravels	Fox (kame phase), Rodman
FLUVIAL DEPOSITS	Terraces		
	a) High Level	Silt over outwash; sand and gravel	Ockley (With minor Fox), Rodman on scarps
	b) Low Level	Outwash; sand and gravel to silt and sand, variable	Fox, Rodman on scarps; (minor Homer, Westland, Martinsville, Whitaker)
	Flood Plain	Silt and sand, alluvium	Genesee, Eel, Nineveh, Ross, Shoals, Sloan
EOLIAN DEPOSITS	Plain	Silt, loess	Manlove, Birkbeck, Reesville
MISCELLANEOUS DEPOSITS	Plateau	Interbedded limestone and shale on the surface or at shallow depths	Fairmount, Milton, Wynn
	Depression	Cumulose drift	Cope, Brookston, Kokomo

a readvance of Wisconsin ice extends across the northwest corner of the county. Some kames and eskers are associated with the other Wisconsin deposits.

Ridge Moraine - Silty Clay Texture

A low ridge moraine, part of the Shelbyville morainic system, extends east-west across the northwestern part of the county. Local relief in this moraine is not great, rarely exceeding 20 feet except near a creek in the northeast where local erosion has occurred.

The soils are dominantly silty clays. The A-horizon, is usually a silty clay loam; The B- and C- horizons are either a clay, or silty clay.

Ground Moraine - Silty Texture

The ground moraines lie to the south of, and are older than, the ridge moraine in the northwest corner of the county. Most of these soils have some wind-blown silt on the surface. This serves to greatly increase the silty texture of the near surface horizons, and in places reaches five feet thick. Areas where this silt deposit is over three feet thick have been mapped as separate loess areas.

The silt cover has tended to smooth the rolling topography so that uneroded areas are quite level. However this area has been considerably dissected by the many small tributaries of the Whitewater River. This dissection increases greatly near the Whitewater River and its major tributaries so that very little level topography remains.

The upper portions of soil profiles are very silty; the lower parts of the profiles are silty clays or clays. The A-horizon may be a foot thick and is usually a silty loam or silty clay loam. The B-horizon is normally a silty clay and the C-horizon a clay or silty clay.

Illinoian Ground Moraine - Silty Texture

Illinoian Ground Moraine is found in the south-central part of Fayette County. On level upland areas 10 to 60 inches of wind-blown silt overlie the Illinoian till which is more clayey. Extensive areas of steep slopes occur due to dissection by the many creeks and gullies. In these areas very thin soil profiles are found overlying interbedded limestone - shale bedrock.

In upland areas the A-horizon is about 12 inches thick and is classified as a silty loam. The B-horizon extends to depths of 60 to 78 inches and is generally a silty clay or clay. The C-horizon is also a silty clay or clay and normally contains only a very few small pebbles.

Where erosion has occurred the soil profile is generally less than a foot deep with a silty textured A-horizon a few inches thick, and a B-horizon of silty-clay extending down to about 12 inches. Where rock is very close to the surface flat slabs of limestone are common throughout the soil profile.

Eskers and Kames - Sandy and Gravelly Texture

Several kames and short esker-like ridges are found in Fayette County. A concentration of these deposits is found on the east side of the Whitewater valley, southeast of Connersville, and extends in a discontinuous fashion eastward towards Alquina.

The depths and compositions of the various soil profile layers are quite variable. Frequently the A-horizon may be a silty, sandy, or even clayey loam. The depth of the A-horizon ranges from a few inches to perhaps a foot. The underlying B-horizon ranges in composition from silty clay to sandy clay or gravelly clay and may extend to depths of about three feet. The underlying parent material is sand and gravel, sometimes with small amounts of intermixed or interbedded silt and clay.

B) FLUVIAL DEPOSITS

Extensive fluvial deposits are found along the West Fork Whitewater River and along the lower portions of its many small tributaries. Small outwash plains and terraces are found along the abandoned glacial sluiceways in the eastern part of the county. The West Fork Whitewater River exhibits an extensive flood plain, or alluvial plain, and the many creeks exhibit proportionately broad flood plains.

Terraces - Sandy and Gravelly Texture

The terraces along the Whitewater River and its tributaries are generally composed of sands and gravels. These terraces are most extensive in the vicinity of Connersville, although examples of these terraces can be found in other parts of the county.

Two terrace levels can be distinguished. The upper level terraces occur from 20 to 35 feet above the flood plain. These terraces normally have a silty sand cover about three feet thick overlying the sand and gravel. Accordingly the A-horizon can be classified as a silty loam and is often a foot thick. The B-horizon gradually changes from a silty clay to a sandy or gravelly clay with depth. Below about five feet sand and gravel (C-horizon) is encountered.

The lower terraces occur from 5 to 15 feet above the flood plain and normally lack the silt cover so common on the upper terraces. The A-horizon is usually a foot thick and is generally a loam. The B-horizon rapidly grades downward into a sandy or gravelly clay and rarely extends below three feet. The underlying parent material is stratified sand and gravel, or sand and silt, and is quite variable.

Alluvial Plains

The alluvial plains shown on the map include the flood plains of the various rivers and creeks and so can be considered as subject to seasonal flooding. These areas are of recent origin, being formed largely from the sediment moved by the water in time of flood. As a consequence these deposits vary greatly from place to place. The top soil varies from loam to silt loam, with some areas being more sandy. In any one area rapid changes from loam, to sandy loam, to silty loam or silty clay loam can be expected. Stratification can be expected in some places. Within the valley of the Whitewater River the substratum ranges from silty clay to gravelly material with in short distances.

C) EOLIAN DEPOSITS

Loess deposits are the only eolian or wind deposited materials occuring as mappable units in Fayette County.

Loess Deposits

Most of the Wisconsin ground moraine is covered with a thin layer of wind-blown silt. In a few locations this silt deposit attains a considerable thickness and these areas have accordingly been mapped as loess deposits. Three feet of wind-blown silt was taken as the lower limit of such loess deposits; this depth coincides with the separation between the Birkbeck-Reesville-Manlove soil series and the Fincastle-Xenia-Russell soil series.

These silt deposits range from three to five feet thick in Fayette County and are underlain by Wisconsin till. The A-horizon is about one foot thick, and is silty loam. The B-horizon and C-horizons are also silty loams whose thicknesses vary according to the total depth of the loess deposit. The base of the loess deposit is marked by an abrupt change to a clay or silty clay (the Wisconsin till).

D) MISCELLANEOUS DEPOSITS

Several areas of highly organic topsoils have developed in depressions and poorly drained areas in the upland areas of Fayette County. There are also several areas in the southern part of the county where bedrock is at or near the surface. These regions are grouped under miscellaneous deposits.

Highly Organic Topsoil

Highly organic topsoil is found in depressions or other areas where drainage is retarded. Such areas are most commonly found in the Wisconsin ground and ridge moraines in the western part of the county. This area is relatively distant from the West Fork Whitewater River Valley and as a consequence stream erosion has not yet increased the local relief so that the natural drainage is slow. In general, these deposits are not deep in Fayette County and thus should not pose major construction problems. However these areas should be carefully field checked to determine the amount of material to be removed during construction.

Bedrock Near Surface

In several local areas in southern Fayette County bedrock is found at the surface or at very shallow depths. The bedrock consists of interbedded limestones and shales. The limestone tends to be thinly bedded and thus erosion often produces talus slopes of slabby limestone intermixed with shale fragments.

The most extensive areas of bedrock outcrop are found along Bear Creek and along the east side of the southern most portion of the West Fork Whitewater River valley in Fayette County, southeast of Alpine. Other important outcrops are found along the lower portions of Garrison Creek west and south-west of Alpine. However bedrock is encountered in most of

the lower portions of the small creeks in the southern part of the county. The channels of these creeks are covered with small blocks of flaggy limestone.

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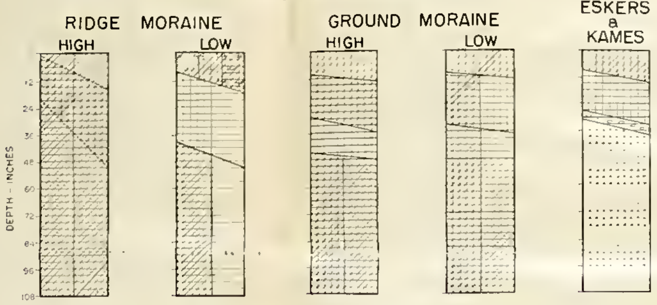
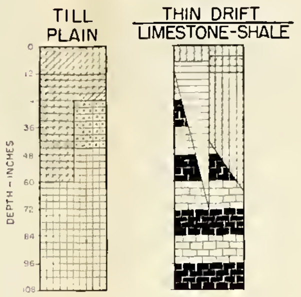
GENERAL SOIL PROFILES

GLACIAL DEPOSITS

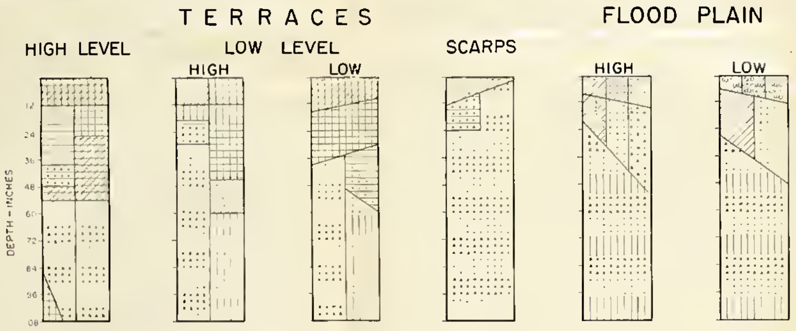
WISCONSIN DRIFT



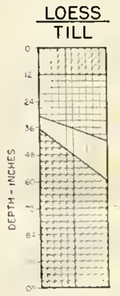
ILLINOIAN DRIFT



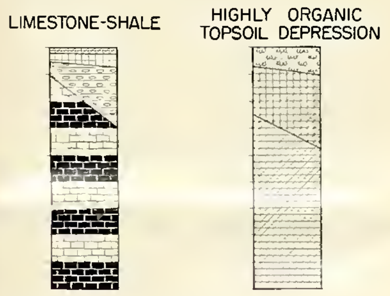
FLUVIAL DEPOSITS

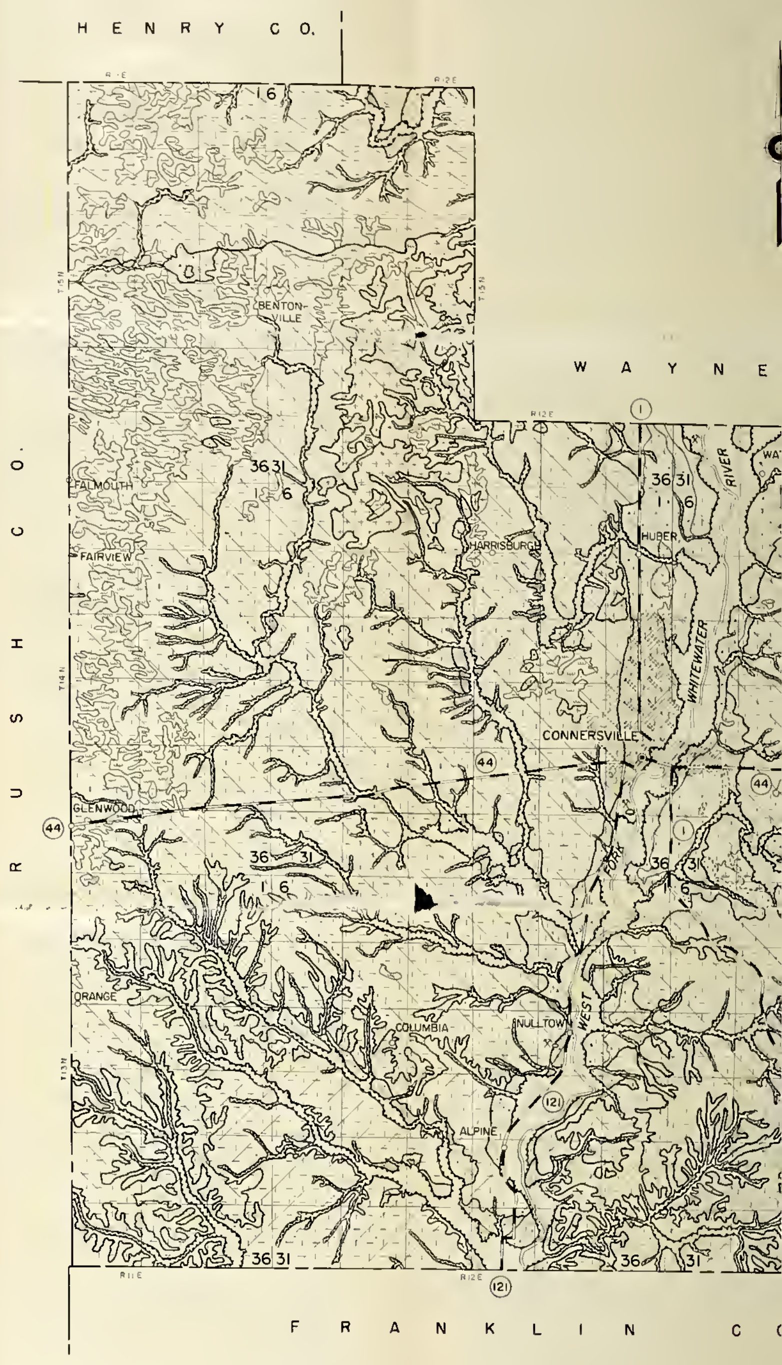


EOLIAN DEPOSITS



MISCELLANEOUS DEPOSITS





ENGINEERING SOILS MAP

FAYETTE COUNTY

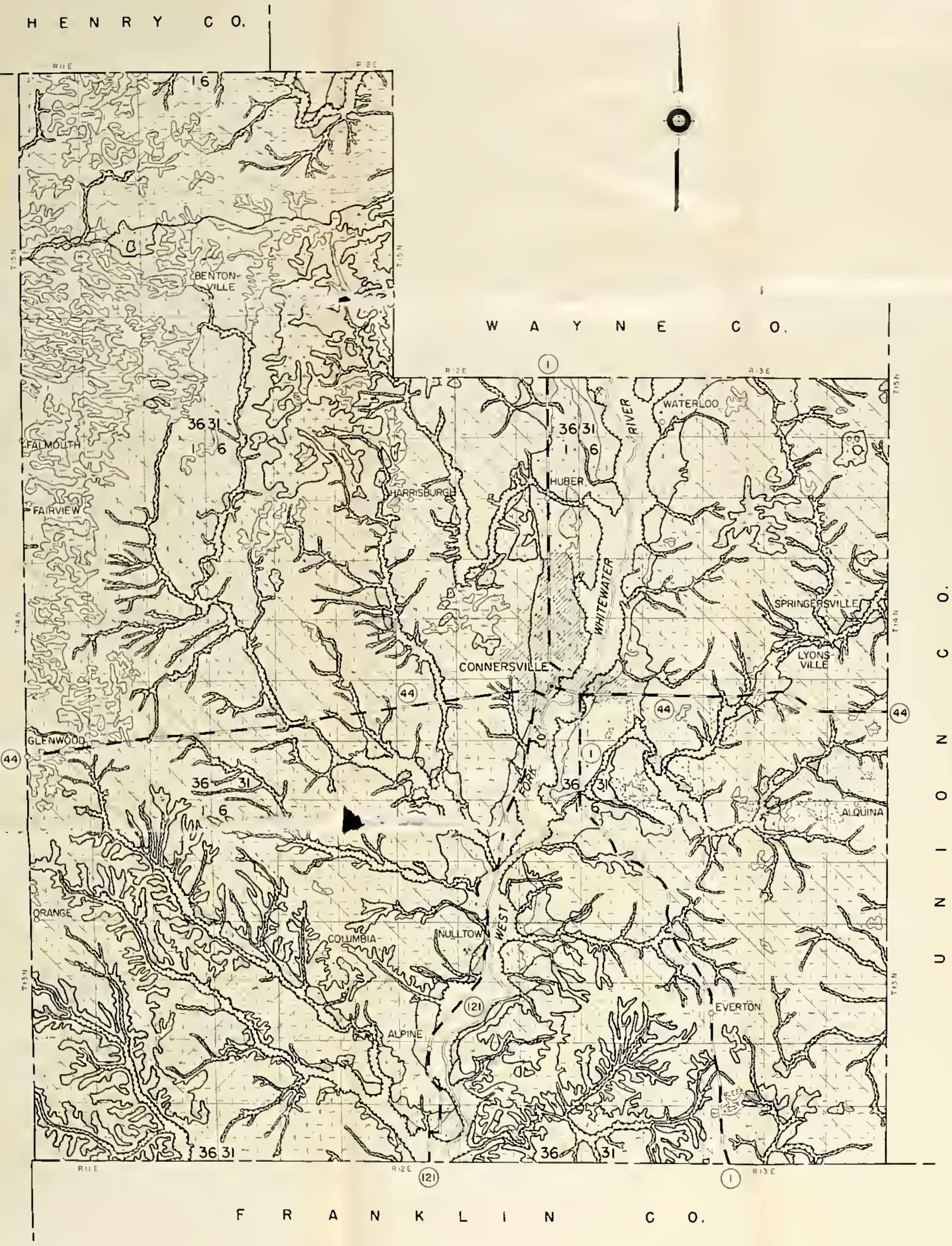
INDIANA

PREPARED FROM
1940 AAA AERIAL PHOTOGRAPHS
BY
JOINT HIGHWAY RESEARCH PROJECT, PURDUE UNIVERSITY
SPONSORED BY
INDIANA STATE HIGHWAY COMMISSION
SOIL CONSERVATION SERVICE
AND
BUREAU OF PUBLIC ROADS
1967

SCALE OF MILES
3/4 1/2 1/4 0 1 2 3 4

PREPARED UNDER THE SUPERVISION OF A. K. TURNER

POLYCONIC



LEGEND

PARENT MATERIALS

(GROUPED ACCORDING TO LAND FORM AND ORIGIN)

- WISCONSIN GROUND MORAINE
- ILLINOIAN GROUND MORAINE
- RIDGE MORAINE
- TERRACE
- FLOOD PLAIN
- LIMESTONE - SHALE
- LOESS

MISCELLANEOUS

- GRAVEL PIT
- HIGHLY ORGANIC TOPSOIL
- KAME AND ESKER
- MARSH

TEXTURAL SYMBOLS

(USED [illegible] PARENT MATERIAL SYMBOLS TO SHOW RELATIVE COMPOSITION)

- GRAVEL
- SAND
- SILT
- CLAY

TEXTURAL SYMBOLS FOR SOIL PROFILES

- GRAVEL
- SAND
- SILT
- CLAY
- LOAM
- STONY
- ORGANIC MATTER
- LIMESTONE
- SHALE

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1967

SCALE OF MILES

POLYCONIC PROJECTION

DRAWN BY Y. TANG

JHRP 67/17